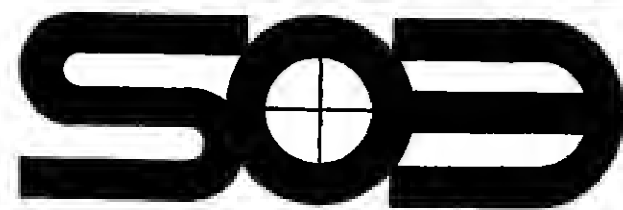




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VOLUME 62, NUMBER 39, SEPTEMBER 22, 1981



EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

VOL. 62, NO. 39, PAGES 673-680

SEPTEMBER 22, 1981

## Particles and Fields—Magnetosphere

**5711** *Electric Fields*  
A CAPILLARY INVESTIGATION OF ELECTRIC FIELDS AND  
MAGNETIC FLUXES IN THE MAGNETOSPHERE  
J. L. KILPATRICK (Coulter Corp., 1000 E. 1st St., Suite  
2000, San Antonio, TX 78204), J. L. KILPATRICK  
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**5712** *Interactions between solar wind and  
magnetosphere*  
CONVOLUTIONS BETWEEN SOLAR WIND PARAMETERS AND  
MAGNETOSPHERIC PARAMETERS  
J. L. KILPATRICK (Coulter Corp., 1000 E. 1st St., Suite  
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## Editorial

### Why Contribute to AGU?

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Bob Engdahl  
President, AGU Seismology Section

## News

### Research Planned for Marginal Ice Zones

World interest in and awareness of the polar regions has developed at an accelerated pace over the past decade. This interest has stemmed from a variety of factors, including increased resource utilization, increased use of polar seas as shipping corridors, and a growing realization that sea ice must be incorporated into any viable global climate prediction scheme. In the 1970's this interest led to implementation of such programs as the Arctic Ice Dynamics Joint Experiment (AIDJEX) and the Arctic Ice Buoy Program, all of which addressed oceanographic and sea ice problems in the central Arctic Basin.

The more difficult, and possibly more significant, problems remain, however, those concerning the variable extents of the sea ice fields in both hemispheres. These variations occur with the greatest intensity in the marginal ice zones, where the floating ice, oceans, and atmospheres are in constant physical contact and dynamic interaction. This realization led the U.S. National Academy of Sciences (NAS) in 1974 to recommend commencement of theoretical and field programs that would address marginal ice zone problems by the late 1970's. Similar recommendations were adopted by the Global Atmospheric Research Program (GARP) a few years following the NAS statement. Most recently, the World Meteorological Organization has reiterated the significance of the marginal ice zones in influencing climate and has recommended implementation of a study program.

In response to these stated needs, an international team of scientists is in the process of formulating a plan to develop scientific research strategies relevant to the marginal ice zones. Building upon experience gained in large part from

AIDJEX and the Data Buoy Programs in the Arctic Ocean, from the Norwegian Sea through the Norwegian Sea Experiment (NORSEX), and from the Bering and Chukchi seas through various programs, these scientists have identified two major research objectives. The first is to develop an understanding of the mesoscale (of order hundreds of kilometers) processes associated with air-sea-ice interaction in the marginal ice zones. The second is to understand the dynamics of the large-scale interactions more likely to directly impact global climate.

Planning of an experiment to address the first of these objectives is well under way at the present time. The resulting Marginal Ice Zone Experiment (MIZE) proposes to utilize a combination of field programs and theoretical analysis to investigate mesoscale interactions between air, ice, and water in the marginal ice zones. Field programs are proposed for the Bering and Greenland seas, each of which is characterized by a different set of oceanic and atmospheric conditions, commencing in 1983. Coincident experiments will also be carried out in the marginal ice zone in the Labrador Sea under the auspices of the Labrador Ice Dynamics Experiment (LIDEX). Scientific problems of particular high priority include definition of an ice rheology law for the marginal ice zones; identification of the dominant processes for air-sea-ice interaction along an ice edge, such as frontal development, eddy formation, and double-diffusive phenomena; and melting and freezing processes and their effects upon the underlying waters. Knowledge of these processes will greatly enhance our understanding of vertical and lateral heat transfer through the marginal ice zones and will contribute substantially to an overall understanding of the roles that marginal ice zones play in global climate dynamics.

This news item was contributed by Robin Muench of SAU Northwest and Norbert Unterwiesing of the University of Washington.

### Solar Mesosphere Explorer

The Solar Mesosphere Explorer is an atmospheric research satellite designed to study reactions between sunlight, ozone, and other chemicals in the atmosphere and how concentrations of ozone are transported in the atmosphere in the region from 30-km to 80-km altitude. At present, the satellite was scheduled to be launched no earlier

than October 3 at 7:27 A.M. EDT. At least one year of orbital operation is planned.

The objectives of the Solar Mesosphere Explorer project are:

- to provide a comprehensive study of atmospheric ozone and the processes that form and destroy it above 30 km;
- to determine what changes occur in ozone distribution as a result of changes in incoming solar radiation;
- to measure changes in ozone density distribution in the altitude range of 30-90 km and to determine the causes of those changes;

- to simultaneously measure temperature, pressure, water vapor, nitrogen dioxide, near-infrared airglow, and the amount of incoming solar radiation;

- to determine what solar-terrestrial correlation exists and the paths that lead to changes in ozone density;
- to determine other changes in ozone abundance and distinguish them from changes caused by the sun.

Five instruments will simultaneously monitor ozone and minor atmospheric constituent quantities, water vapor abundance and temperature, and the amount of incoming solar radiation to determine the role each plays in ozone production and distribution throughout the mesosphere. Scientific data from the mission will help to develop models for ozone production and depletion on a global scale.

(The mesosphere is the region of the atmosphere between 30-km and 80-km altitude, i.e., above the stratosphere and below the ionosphere. Radiation of short wavelength in that region causes a variety of photochemical reactions; the most notable is creation of a layer of ozone that effectively absorbs solar ultraviolet radiation and causes a warm layer at about 30-km altitude.)

The experiments are:

- an ultraviolet ozone spectrometer—to measure ozone ( $O_3$ ) between 40-km and 70-km altitude;
- a 1.27- $\mu$ m spectrometer—to measure ozone between 50-km and 90-km altitude and hydroxyl (OH) between 60-km and 90-km altitude;

- a nitrogen dioxide spectrometer—to measure  $NO_2$  between 20-km and 40-km altitude;

- a four-channel infrared radiometer—to measure temperature and pressure between 20-km and 70-km altitude and water vapor and ozone between 30-km and 65-km altitude;

- a solar ultraviolet monitor—to measure incoming radiation from the sun.

### NSF FY1982 Update: Support for Basic Research

When the Appropriation Committees of the House of Representatives and the Senate meet in conference this month, discussion of the Astronomical, Atmospheric, Earth, and Ocean Sciences (AAEO) sections of the National Science Foundation (NSF) will be limited. Both the House and the Senate committees made some slight increases to the Office of Management and Budget requests, and the program by program agreement between the two was unusual.

The House appropriation bill, H. R. 4034, provides \$70 million over the administration request of \$1033.5 million. Of the increase, \$44.9 million was added in the area of research and related activities and \$25.1 million for science and engineering education.

The Senate version of the appropriations bill is similar, containing an increase of \$14 million over the administration request. The increases in the Senate's version emphasized support for foreign programs, for 2- and 4-year college instrumentation requests, and for science education activities, especially in the form of support for graduate study.

The overall AAEO budget request is increased by approximately \$7-8 million, according to a spokesman in the

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Published data on geological and geophysical research in the eastern Himalayan belt are frequently difficult to find outside the countries of the region. Fewer still are readily available authoritative syntheses such as those presented in the volume, which describes many aspects of orogeny in the Zagros, Hindu Kush, and Himalaya fold belt.

**Anelasticity in the Earth** (1981), edited by F.D. Stacey, M.S. Paterson, A. Nicolas, 128 pages, illustrated, (G00400), \$15.00.  
Authoritative statements on two related phenomena in the earth's mantle: the damping and associated dispersion of seismic waves; and steady inelastic deformation (creep). Several papers report recent work on atomic and crystal-line mechanisms. Application to mining problems as well as fundamental mantle physics are included.

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The last chapter of a technical nature is a particularly impressive one. Chapter 17 deals with satellite photogrammetry, a field that was given major impetus by the lunar mapping projects of the Apollo missions and which should further advance with the space shuttle program. Among the topics covered in this chapter of nearly 100 pages are accounts of orbit geometry and basic orbital dynamics, stellar reference coordinate systems, the spacecraft mode of an

*Olive S. Fraser is with the Division of Surveying Engineering, The University of Calgary, Calgary, Alberta, Canada.*



## Physical Oceanographer

\$A24,951-\$A33,616 pa  
CSIRO Marine Laboratories  
Division of Oceanography  
Sydney NSW, Australia

CSIRO has a broad charter for research into primary and secondary industry areas. The organization has approximately 7400 employees—2500 of whom are research and professional scientists—located in divisions and sections throughout Australia.

**GENERAL:** In March 1981, the CSIRO Division of Fisheries and Oceanography was formally separated into a Division of Fisheries Research and a Division of Oceanography. These divisions collectively form the CSIRO Marine Laboratories, and are Australia's principal marine laboratories, employing about 200 scientists and support staff. The main laboratory is in Sydney, and there are smaller laboratories in Brisbane and Perth.

Depending on Parliamentary approval, the Sydney activities will be transferred to new laboratories to be constructed on a deep waterfront site in Hobart, Tasmania. Appointees must be prepared to transfer to Hobart at any time after December 1982. The Australian Government has also agreed to the acquisition by CSIRO of a modern oceanographic ship to replace the presently chartered 'Sprightly'.

**DUTIES:** To be responsible for establishing a receiving station for High Resolution Picture Transmission data from the US NOAA series of satellites to supply data to various CSIRO Divisions and to outside users. The appointee will undertake oceanographic research using these data and advise CSIRO on further applications of satellite remote sensing to oceanography.

**QUALIFICATIONS:** A Ph.D. in physics or equivalent qualifications with substantial research experience in physical oceanography or closely related geophysical fields. Experience in electronics and computer data reduction, the use and analysis of satellite imagery for oceanographic studies, and the research programs of NASA would be an advantage. The ability to work at sea would also be an advantage.

**TENURE:** Indefinite with superannuation.

**APPLICATIONS:** In writing, quoting reference A1459, giving full personal particulars including details of qualifications and experience, copy of academic transcript and the names of at least two professional referees should reach:

The Chief  
Division of Oceanography  
CSIRO  
P.O. Box 21  
Cronulla NSW 2230  
AUSTRALIA

DEADLINE: October 12, 1981.

CSIRO

## Physical Oceanographers

(2 positions)  
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CSIRO Marine Laboratories  
Division of Oceanography  
Sydney NSW, Australia

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The interests of the Division in physical oceanography include continental shelf dynamics, mixed layer and upwelling dynamics, air-sea interaction, ocean circulation and boundary currents, the interpretation and application of satellite data, numerical modelling and geophysical fluid dynamics.

**DUTIES:** The appointees will initiate and conduct research within these fields and in relation to existing or future programs. On occasions, they may be expected to participate in or in lead research vessel cruises.

**QUALIFICATIONS:** Successful applicants would normally hold a Ph.D. in physical oceanography, geophysical fluid dynamics or some other relevant discipline and should be able to demonstrate substantial research experience and achievement commensurate with their experience.

**TENURE:** Fixed term appointments of 3-5 years. Superannuation benefits available.

**APPLICATIONS:** In writing, quoting reference A1576/1644, giving full personal particulars including details of qualifications and experience, copy of academic transcript and the names of at least two professional referees should reach:

The Chief Division of Oceanography  
CSIRO  
P.O. Box 21  
Cronulla NSW 2230  
AUSTRALIA

DEADLINE: October 12, 1981.

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## Applications are invited for a newly created CHAIR IN GEODYNAMICS AND TECTONICS

University of Uppsala, Sweden

Closing date: October 30, 1981.

It is expected that the applicants are competent in essential parts of the research field, which comprises the physical processes involved in the dynamic evolution of the earth's crust and mantle. Structural geology, the analysis of deformation processes and the study of the rheological properties of rocks are important components of this field of research. Applications of experimental and theoretical models are of paramount significance for the interpretation of complex geological structures.

Laboratory facilities for experimental modelling are well developed at the department.

Bachelor research the professorship involves sponsoring graduate students and giving advanced courses in his field.

Current starting salary: 140 000 Sw. Kr. per year.

Applications, including four copies of curriculum vitae and published papers (as well as unpublished manuscripts), should be addressed to:

The Swedish Government  
Registrar  
University of Uppsala  
Box 256, S-75105  
Uppsala, Sweden.

## AIR FORCE GEOPHYSICS LABORATORY CHIEF SCIENTIST

Air Force Geophysics Laboratory invites applications for the position of chief scientist located at Hanscom Air Force Base, Massachusetts. The Laboratory is responsible for Air Force research and development in atmospheric physics, solar-terrestrial interactions, ionospheric and stratospheric phenomena, aeronomy, meteorology and weather phenomena, geodesy, gravimetry, seismology and related technologies.

The chief scientist serves as an interface between the scientific researchers of the Laboratory and the outside professional technical community. He recommends promising areas for new research and attempts to enhance the professional stature and reputation of the organization and its scientific output of publications and technical reports.

A candidate should have a record of distinguished achievement in geophysics or atmospheric physics as a research scientist. This position is Air Force Senior Executive Service with a salary range of \$52,247 to \$57,673, subject to current \$50,112 ceiling.

For an application package, call collect:

Mr. Robert Ellerin, (617) 861-2896  
or  
Mr. Joe Sullivan (617) 861-4581.

To be considered, applications must be returned by 30 October 1981.

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**Director, Office of Programs and International Affairs.** The Office of Research and Development, National Oceanic and Atmospheric Administration (NOAA), has announced the vacancy of Director, Office of Programs and International Affairs, located in Rockville, Maryland. The Office of Research and Development is responsible for administering an integrated program of research, technology and advanced engineering development and transfer relating to the ocean, the Great Lakes, the U.S. coastal waters, the lower and upper atmosphere, and the solar and terrestrial environment to increase understanding of the environment and human impact thereon, and thus provide the scientific basis for improved services. The Director, Office of Programs and International Affairs, oversees the coordinated development of policy, programs and budgets, and international activities within the Office of the Assistant Administrator for Research and Development. This is an exciting and challenging opportunity for an individual with demonstrated knowledge of (1) oceanographic, meteorological, environmental, physical and/or engineering sciences (including at least 24 semester hours in physical science and/or closely related engineering sciences at the college level or above), or (2) program analysis techniques and methods involving broad experience in scientific and technological programs related to the ocean and the atmosphere. A knowledge of U.S. policies on treaties and international multilateral and bilateral agreements is desirable.

**SALARY:** This position will be filled under the General Executive Service (SES). Salary could range from \$47,860 to \$50,112.50 per annum.

**APPLICATION:** Interested persons should send a U.S. Standard Form 171, Personnel Qualification Statement by October 9, 1981, to Mrs. Susan Cisar, Personnel Management Specialist, Office of Personnel, MB/PER-11, NOAA, 8001 Executive Boulevard, Rockville, Maryland 20852.

The Department of Commerce, National Oceanic and Atmospheric Administration is an equal opportunity employer.

**Position in Refraction Seismology/Rice University, Houston, Texas.** The Department of Geology plans to expand its geophysical program. Emphasis will be on reflection seismology. At this time applications are for the first of two faculty positions. The successful applicant will be in the search for and selection of the second faculty member.

Your main responsibility will be to lead our department into the area of modern reflection seismology. Your main teaching and research interests should be in the acquisition and processing of reflection seismic data. You should also help in developing rigorous undergraduate and graduate curricula, which are supported by the traditional strength of the Earth Sciences, Physics, and Electrical Engineering Departments at Rice. Enthusiasm to work with and undertake some joint projects with our geologists is essential.

Our plans are to acquire a computer system configured for high quality data processing. Substantial seed money for this facility is already in hand. Creative cooperation with the oil and geophysical industry in Houston, including a reasonable amount of consulting, is encouraged. Salary will be commensurate with qualifications and experience. Please send your curriculum vitae, a summary of experience in seismic processing, a statement of research interests, and names of three or more references to Dr. A. W. Bally, Chairman, Department of Geology, Rice University, P.O. Box 1882, Houston, Texas 77001. Application deadline—October 1, 1981.

Rice is an equal opportunity employer.

**Director, Geodetic Survey, NOAA.** The National Oceanic and Atmospheric Administration (NOAA) announces a Senior Executive Service Vacancy for the position of Director, Geodetic Research and Development Laboratory (GRDL) in the National Ocean Survey, a component of the National Ocean Survey. The duty location is Rockville, Maryland. The salary range is \$47,860-\$50,112.50 per annum. Duties include providing technical and administrative supervision over employees and activities of GRDL; advising officials on the state of scientific knowledge in geodesy and making recommendations for research and development; exercising scientific and technical knowledge of contribution to professional journals and making presentations at national and international meetings; and advising and consulting scientists and executives in improvement of geodesy and related fields. Experience in management of scientific programs, geodesy, and solid earth sciences is required. Apply to: NOAA/NDSD-8001 Executive Boulevard, Rockville, Maryland 20852. Attn: MB/PER-11.

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**Geologist, The State University of New York at Binghamton.** The State University of New York at Binghamton has a vacancy for a geologist at assistant professor level. Ph.D. degree held with research interest in exploration seismology or earthquake seismology with solid theoretical background are welcome to apply.

The successful candidate is expected to teach courses in applied geophysics, time series analysis, wave propagation, etc. Ph.D. with 0 to 5 years of teaching, research and/or industrial experience is appropriate for the position. Salary negotiable and competitive with academic institutions. Position available September 1, 1982.

Please send resume and names of three references to: Chairman, Geophysical Search Committee, Department of Geological Sciences, State University of New York at Binghamton, New York 13901.

We are an equal opportunity/affirmative action employer.

**Virginia Polytechnic Institute and State University/Senior Research Associate.** Interesting and abundant research and publishing opportunities, including new University-owned MOS-VIAHOSIS system, VAX 11/780 computer. Must have experience in theory and application of reflection seismology, and be interested in the application of reflection seismology to the solution of geologic problems.

Send resume to: Dr. O. R. Wones, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0798.

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### Faculty Positions The University of Iowa

The Department of Physics and Astronomy anticipates one or two openings for tenure-track faculty in August 1982. One or more visiting professorships, at any rank, are also expected to be available. Preference will be given to candidates with research activity in the following experimental and theoretical areas: astrophysics, astrophysics, atomic physics, condensed matter physics, elementary particle physics, nuclear physics, plasma physics, and space physics. The positions involve undergraduate and graduate teaching, guidance of research students, and personal research. Interested persons should send a resume, a statement of research interests, and the names of three professional references to Search Committee, Department of Physics and Astronomy, The University of Iowa, Iowa City, IA 52242.

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**Faculty Positions, Arizona State University, Department of Geology.** Applications are invited for two tenure-track faculty positions, one at the assistant professor level and one at the associate level, beginning in August of 1982. One of these positions requires a candidate with interests in applying modern solid state science to geological phenomena. The selected candidate should develop an active research program and may use the extensive opportunities offered by the Faculty for High Resolution Electron Microscopy at ASU. Teaching duties will include undergraduate and graduate level courses for the other position should complement and extend existing strengths in the department. Possible areas include low temperature geochemistry, heavy isotope geochemistry, solid earth geophysics, tectonophysics, and related fields. The ability to use modern techniques in both field and laboratory studies and to integrate diverse approaches is highly desirable. Please send a detailed statement of research and teaching interests and a resume with names of four references to David Kinsley, Department of Geology, Arizona State University, Tempe, AZ 85287, by January 15, 1982.

Arizona State University is an equal opportunity/affirmative action employer.

**Senior Faculty Position Meteorology.** Applications and nominations are invited for a senior faculty position in meteorology, at the University of Utah. Eligible applicant will also be considered for chairperson of the department. Candidates must possess a Ph.D. in meteorology or a related discipline. Applicants should have teaching and research experience and be interested in participating in both the graduate and undergraduate programs. Applicants should submit curriculum vitae and names of three professional references to:

Dr. Jan Pease  
Search Committee  
Department of Meteorology  
University of Utah  
Salt Lake City, Utah 84112

Deadline for applications November 30, 1981.

The University of Utah is an affirmative action equal opportunity employer.

**Geologist, The State University of New York at Binghamton.** The State University of New York at Binghamton has a vacancy for a geologist at assistant professor level. Ph.D. degree held with research interest in exploration seismology or earthquake seismology with solid theoretical background are welcome to apply.

The successful candidate is expected to teach courses in applied geophysics, time series analysis, wave propagation, etc. Ph.D. with 0 to 5 years of teaching, research and/or industrial experience is appropriate for the position. Salary negotiable and competitive with academic institutions. Position available September 1, 1982.

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Send resume to: Dr. O. R. Wones, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0798.

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**Pedrogoni Northern Illinois University.** Applications are invited for a tenure track position in igneous or metamorphic petrology at the assistant or associate professor level beginning either January, 1982 or August, 1982. A Ph.D. degree is required and postdoctoral research experience is preferred. The successful candidate will be expected to pursue an active research program, teach at the undergraduate and graduate level, and direct Masters and Ph.D. graduate research work. Facilities housed within the Department of Geology include a fully automated electron microprobe, SEM, solid-state and gas-source mass spectrometers, AA, XRF, and XRF. To receive full consideration, send resume, statement of research interests, and the names of three references, by November 1, 1981, to Jonathan H. Berg, Search Committee Chairman, Department of Geology, Northern Illinois University, DeKalb, Illinois 60115.

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**Postdoctoral Awards in Ocean Science and Engineering.** Woods Hole Oceanographic Institution invites applications for 1-year postdoctoral fellowships from new and recent doctorates in the fields of biology, chemistry, engineering, geology, geophysics, mathematics, meteorology, and physics, as well as oceanography. Recipients of awards are selected on a competitive basis, with primary emphasis placed on research promise.

Fellowship stipend is \$20,000. Appointees are eligible for group health insurance and a modest research budget. Recipients are encouraged to pursue their own research interests independent of or in association with resident staff. Completed applications must be received by February 1, 1982 for 1982-83 awards. Awards will be announced in March. Write for application forms to: Dean of Graduate Studies, P.O. Box E, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543.

Equal Opportunity/Affirmative Action Institution

**Faculty Position Environmental Engineering.** Beginning January of September 1982. The position requires undergraduate and graduate teaching and sponsored research activities in the area of water quality control and water resources. An earned doctorate is required and at least one degree in civil engineering is preferred. Rank will be at the assistant professor level and salary will depend upon qualifications. Apply to: Dr. Lester A. Hoel, Chairman, Department of Civil Engineering, University of Virginia, Charlottesville, Virginia 22901.

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**City University of New York (Brooklyn College) Faculty Positions.** The Department of Geology anticipates filling several tenure track positions at Full Professor level (Salary range up to \$43,400). Highly qualified individuals will be considered for distinguished appointments at an additional \$5,000.

While candidates who have distinguished themselves in any field are welcome to contact us, we are particularly interested in openings in energy resources (coal petroleum), exploration geophysics, environmental geology or hydrogeology, coastal sedimentology, economic geology. Successful applicants will be required to include an active research program, supervise Master's and Ph.D. theses. Nominations and applications with current vitae should be sent to: Dr. S. Bhattacharya, Chairman, Dept. of Geology, Brooklyn College of City University of New York, Brooklyn, New York 11210. Positions open until filled.

Brooklyn College, CUNY, is an affirmative action equal opportunity employer.

**Geophysics Position.** The Physics Department of the University of New Orleans invites applications for tenure track positions available January 1982 or August 1982. Rank and salary are to be commensurate with experience and training. Candidates with background in geophysics, acoustics or computational physics are especially encouraged to apply. The UNO departments of Earth Sciences and Physics are jointly developing programs and curricula to respond to the demand for graduates in geophysics in the local metropolitan area and in the south central U.S.

The successful applicant can expect collaborative research support from faculty active in signal processing and enhancement techniques and in inverse scattering analysis. Other areas of departmental research include atomic, molecular, and solid state physics, cryogenic geophysics, hydrodynamics and computational physics. Applicants should send a resume to Professor J. Murphy, Search Committee, Physics Department, University of New Orleans, New Orleans, LA 70148.

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**Purdue University.** The Department of Geosciences invites applications for a faculty position, starting January or July 1982, in the broad field of mineralogy/petrology/geochemistry. A Ph.D. is required and preference may be given to scientists with an established record of research. The Department has an automated electron microprobe, mass spectrometer and laboratory for stable isotope studies, full range of high temperature and high pressure equipment, including furnaces for controlled  $10^3$  experiments, as well as X-ray equipment. The successful applicant will be expected to participate in both the undergraduate teaching and graduate studies programs, as well as actively engage in research. Rank and salary are open but will be commensurate with qualifications.

Purdue University is a land grant, state supported institution committed to academic excellence, and is an equal opportunity/affirmative action employer. For further information please contact Dr. Henry D. A. Meyer, Dept. of Geosciences, Purdue University, West Lafayette, IN 47907 (Tel. 317-494-3271).

Closing date for applications is November 10, 1981.

## EARTH SCIENCES

The Lamont-Doherty Geological Observatory of Columbia University invites scientists interested in any field of the earth sciences to apply for the following fellowships: two postdoctoral fellowships, each awarded for a period of one year (extendable to two years in special instances) beginning in September 1982 with a stipend of \$22,500 per annum. Completed applications are to be returned by January 15, 1982. Application forms may be obtained by writing to the Director, Lamont-Doherty Geological Observatory, Palisades, New York 10964. Award announcements will be made February 28, 1982 or shortly thereafter. The Observatory also welcomes applications from candidates for postdoctoral research associate positions in this discipline.

## STUDENT OPPORTUNITIES

**Earth Sciences Assistantships and Fellowships.** Research assistantships and fellowships are available to graduate students in the earth sciences from the Columbia University Department of Geological Sciences. The awards cover tuition and fees, and provide a yearly stipend of between \$8400 and \$9180.

Research is carried out at affiliated institutions including the Lamont-Doherty Geological Observatory, the Goddard Institute for Space Studies, and the American Museum of Natural History. Research topics available to students reflect the interests of the more than 300 Ph.D. level scientists at these institutions and span virtually every area of the earth sciences.

The department encourages applications from students with an undergraduate degree in any of the natural sciences or engineering. For additional information please contact Ms. Ma. Loo, Department of Geological Sciences, Columbia University, Lamont-Doherty Geological Observatory, Palisades, New York 10964.

**Graduate Research Assistantships in Physical Oceanography.** Opportunities for graduate study with Research Assistantship available for students interested in M.S. or Ph.D. programs. A summer program with stipend is open to college juniors. Write: Douglas Caldwell, School of Oceanography, Oregon State University, Corvallis, OR 97331.

**Tectonophysics Assistantships.** Center for Tectonophysics, Texas A & M University, has assistantships available for Ph.D. students in Geology and Geophysics wishing to specialize in applying rock mechanics principles to problems in geotectonics, structural geology, engineering geology, and geophysics. These full-time appointments currently pay \$650 per month for beginning graduate students to \$675 per month for advanced Ph.D. candidates and include waiver of the out-of-state tuition. Write Dr. M. Friedman, Center for Tectonophysics, Texas A & M University, College Station, TX 77843.

## Meetings

### 56th Colloquium of the International Astronomical Union

#### Introduction

Geodesy, geophysics, astronomy, and astrophysics are all exploiting the unprecedented progress in the accuracy of metric measurements made from space and the earth's surface. Measurements of polar motion and earth rotation, crustal deformation and displacement, satellite and planetary motion, and the positions of stars and quasars are all being refined. These new measurements are providing information on plate tectonics and earth dynamics, the earth's variable rotation, the evolution of the moon and planets, the scale of the solar system and the universe, and the local space-time metric. A common requirement of all these investigations is the necessity of a well-defined coordinate system (or systems) to which all relevant observations, theories, and models can be referred and which can be used as a basis for discussion. In view of the widespread use and interdisciplinary implications of these observations, there is a need for the definition, practical realization, and international acceptance of a suitable coordinate system (or systems) to facilitate such work. The need, the scope of the issues, and the nontriviality of the problem is evidenced by the past dozen years: Strassburg (Markowitz and Guinot, 1968), Morioka (Melchior and Yumi, 1972; Yumi, 1971), Torun (Kijaczek and Welfenbach, 1974), Columbus (Mueller, 1975; 1978), Kiev (Federtov et al., 1980), San Fernando (McCarthy and Pilkington, 1979), and recently, Warsaw (Gapschikh and Kijaczek, 1981). The Warsaw meeting (September 8-12, 1980) is the subject of this review.

Recent advances in metric measurements and models, coupled with the understanding of the mobile earth in terms of plate tectonics, require a reevaluation of the principles and methods used for defining (terrestrial reference frames and establishing terrestrial reference systems. Earth, celestial, and international acceptance of a suitable coordinate system (or systems) to facilitate such work. The need, the scope of the issues, and the nontriviality of the problem is evidenced by the past dozen years: Strassburg (Markowitz and Guinot, 1968), Morioka (Melchior and Yumi, 1972; Yumi, 1971), Torun (Kijaczek and Welfenbach, 1974), Columbus (Mueller, 1975; 1978), Kiev (Federtov et al., 1980), San Fernando (McCarthy and Pilkington, 1979), and recently, Warsaw (Gapschikh and Kijaczek, 1981). The Warsaw meeting (September 8-12, 1980) is the subject of this review.

#### Overview

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life, and solar system dynamics require a more careful definition. Galactic and extragalactic reference systems are being redefined. All these reassessments are fundamental, and none is independent of the others. There is also the need to establish conventions and conventional models. For example, astronomers need to establish lunar and planetary ephemerides for general use in published almanacs and prefer to do so consistent with the best understanding of the actual phenomena. The ephemerides and nutation series used for this purpose cannot be revised capriciously. Therefore there is a need to upgrade the system of astronomical and geophysical constants in a planned and judicious way. These meetings serve as a forum for the users (the scientific community among others) to discuss and debate models, observations, data reduction, and interpretation. Further, as these practical metric observations become operational (for example the geodetic measurement of polar motion and earth rotation will be superseded), the transition to new methods and data sources must be made in a way to preserve the validity of the existing data and allow maximum use of new methods for both the service function and research use of the new data. Finally there is the need for interdisciplinary discussion, in this instance, geodesists, geophysicists, dynamists, as-



onomers, and astrometricists have common interests. The logical intersection of these disciplines occurs at these specialized colloquia, and each discipline is invigorated and rejuvenated through this cross fertilization.

# The Meeting

Planning for the Warsaw meeting occurred in two phases. First, the organizers (B. Kofczek and E. M. Gaposchkin), working with the program committee (J. Kovalevsky, I. I. Mueller, and M. Rochastar) and other interested scientists, developed a list of problems and questions that would be addressed. This list was circulated to a larger number of colleagues, asking for comment and an expression of interest. Second, from these responses a list of review topics and invited papers was established. The speakers were then chosen. We were gratified that very few individuals were unable to accept. The revised list of questions and problems was circulated to the review and invited speakers with a request to address specific topics as well as any they considered relevant. With this preparation the final program was nicely balanced.

The meeting began with eight papers by I. I. Mueller, P. L. Bender, G. Veis, H. Moritz, E. M. Gaposchkin, J. D. Mulholland, J. Kovalevsky, and K. Lambeck, in that order. These review papers served to identify the issues, display the panorama, and focus the discussion. The remaining time was divided into four parts. Invited and contributed papers were given in each part. The number of papers and the amount of time allotted was arranged to allow for discussion of each paper and for conduct of an open discussion at the end of each part. In this way, formal presentations were combined with discussion and debate. Each discussion leader focused the discussion and provided a résumé for the conference summary given by J. Kovalevsky and I. I. Mueller. The manuscripts were reviewed at the meeting, and changes resulting from the discussion and review were incorporated into the proceedings.

The first part was largely a discussion of theory, observation, and interpretation of polar motion, earth rotation, precession, and nutation. The second part discussed terrestrial coordinate systems established with satellite, space, and classical methods. This included a discussion of dynamical systems for artificial earth satellite motion. The third part, concerned with planetary and lunar reference systems, was basically a discussion of how phenomena of the planets, minor planets, and the moon are established. The fourth part addressed the establishment of stellar reference systems, the imminent FK5 catalog, extragalactic reference systems, VLBI catalogs and their relation to stellar catalogs, and the forthcoming Hipparcos astrometry satellite. The discussion leaders (M. Rochastar, H. Moritz, J. D. Mulholland, and C. Murray) did an excellent job of focusing the discussion and extracting the main issues for the final review.

# Discussion and Results

In such a wide-ranging discussion, there were far too many salient points to review here, and the interested reader is referred to the proceedings (Gaposchkin and Kofczek, 1981), which is now available. From this participant's point of view the important conclusions can be summarized as follows:

1) There seems general agreement that only two basic or fundamental systems are needed: a Conventional Inertial System (CIS) that is attached in some "prescribed way" to extragalactic celestial radio sources and serves as a reference for the motion of a Conventional Terrestrial System (CTS), and a CTS that moves and rotates in some average sense with the earth and is also attached in some prescribed way to a number of dedicated observatories operating on the earth's surface. In the CTS the geomatic and dynamic behavior of the earth would be described in the relative sense, while in the CIS the movements of our plan-

etary system (including the earth) and our galaxy could be monitored in the absolute sense.

2) There is need for certain intermediate systems to be used in theoretical calculation in geodesy, astronomy, geophysics, and astrophysics and to aid in the customary decomposition of the transformations between the reference frames of the two fundamental systems.

3) There seems to be no need to use fundamental systems for strain measurements, which are primarily of interest in the study of tectonic motion.

4) There was lack of agreement on what role should be played by the earth's center of mass in defining the CTS.

5) There seems to be general understanding on how the two basic reference systems should be established. An international agreement through the IAU and the IUGG/IAG is necessary. A resolution was passed and subsequently adopted by the IAU and IAG to establish a working group to

... prepare a proposal for the establishment and maintenance of a Conventional Terrestrial Reference System. This system is to include provisions for the replacement of the presently used terrestrial reference frame (such as the one partially defined by the CIO and the BIH zero meridian), providing continuity and conformance with the IAU 1976 and 1978 resolutions regarding astronomical constants and the theory of nutation, or its possible modification, as well as with the IUGG Geodetic Reference System 1980.

Specialized symposia such as the have individual topics which characterize them in later years. Warsaw in September 1980 had a particular spirit of change and uncertainty in the air. This meeting went by with few of the minor irritants which are due to the nature of the conference. Our Polish hosts and colleagues provided a forum for spirited and penetrating debate, where we could append a maximum of time discussing some puzzling problems and fascinating ideas and a minimum of time going through the extended list of rehearsed results that can occur in this age

of abundant meetings and multitudinous journals. No doubt the proceedings do not reflect the spirited discussion and the insights gained by exposure to neighboring disciplines. They do reflect the concerted effort of many of the contributors to focus their thoughts before the meeting on the set of questions circulated. A number of the contributions were stimulated by the occurrence of the meetings. Perhaps the Warsaw discussions in the fall of 1980 were a transition to a new era. For that we must await the judgment of history.

This meeting report was prepared by E. M. Gaposchkin, with a lot of help from the coorganizer and the program committee.

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# Field Methods in Contaminant Hydrogeology

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This course acquaints the practicing hydrogeologist or engineer with current field investigation techniques for the study of groundwater contamination. The focus is on design and implementation of field programmes for the monitoring of parameters needed in water quality evaluations and environmental impact predictions.

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For information please contact: Jana Lang or E.O. Frind

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# Aeronomy

# 0721 Remote sensing

ANALYSIS OF ATMOSPHERIC ATTENUATION FROM SPACE-BASED TRANSMISSIONS FOR THE SEASONAL VARIATION OF SCATTERING

A. A. Aze (Earth Atmospheric Science Center, Kyoto University, Gokisocho, D-5, Kyoto 606, Japan), T. Nakamura, and S. Kato. Numerical modeling of the solar and lunar scattered radiation in the atmosphere is presented. The effect of atmospheric attenuation on the observed intensity of the radiation is calculated. The effect of atmospheric attenuation on the observed intensity of the radiation is calculated. The effect of atmospheric attenuation on the observed intensity of the radiation is calculated.

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# Geodesy and Gravity

1102 High-order harmonics of the gravity potential field and local gravity anomalies

GRAVITY MODEL IMPROVEMENT FOR SEASAT. L. L. Lerch (Godard Space Research Center, Greenbelt, Maryland) J. C. Marsh, S. H. Klok, R. C. Williamson. Analysis of the data from the Seasat altimeter, a 10 cm precision instrument, requires accurate knowledge of the radial position of the spacecraft for altimetric measurements. The study of tide and ocean circulation as well as for geodetic applications. Initial orbit determinations using the altimeter data and force models gave radial errors approaching 5 meters. The dominant source of this radial error was the gravity field model. Improvements in the gravity field were made by successively incorporating the Seasat laser and United States and British data, the GEOS 100 km altimeter data, and finally, the Seasat altimeter data. With the most recent data set of spherical harmonic coefficients, the radial error was reduced to 1 meter. The gravity field model was improved by incorporating the Seasat laser and United States and British data, the GEOS 100 km altimeter data, and finally, the Seasat altimeter data. With the most recent data set of spherical harmonic coefficients, the radial error was reduced to 1 meter.

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# AGU SCHOLARSHIP ASSISTANCE FOR THE ACADEMIC YEAR 1982-1983

# The June Bacon-Berkey Scholarship in Atmospheric Sciences for Women

Scholarship assistance in the amount of \$450 will again be made available to a woman who intends to make a career in the atmospheric sciences. The award, which is provided through a gift from June Bacon-Berkey, a noted practicing meteorologist, will be made on the basis of academic achievement and promise. To be eligible for this scholarship, a candidate must be one of the following at the time of application:

- a first-year graduate student in a program leading to an advanced degree in the atmospheric sciences;
- an undergraduate in a bachelor's program leading to a degree in the atmospheric sciences, who has been accepted for graduate study in the field; or
- a student at a 2-year institution offering at least 6 semester hours of atmospheric sciences, who has been accepted for a bachelor's degree program in the atmospheric sciences and who has completed all of the courses in atmospheric science offered at the 2-year institution.

Application forms are available from the American Geophysical Union, Member Programs Division, 2000 Florida Avenue, N.W., Washington, D.C. 20009 (202/462-6903). Selection of the awardee will be made by the AGU Subcommittee on Women in Geophysics, in consultation with the AGU Meteorology Section.

DEADLINE FOR RECEIPT OF APPLICATIONS IS MAY 1, 1982.

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